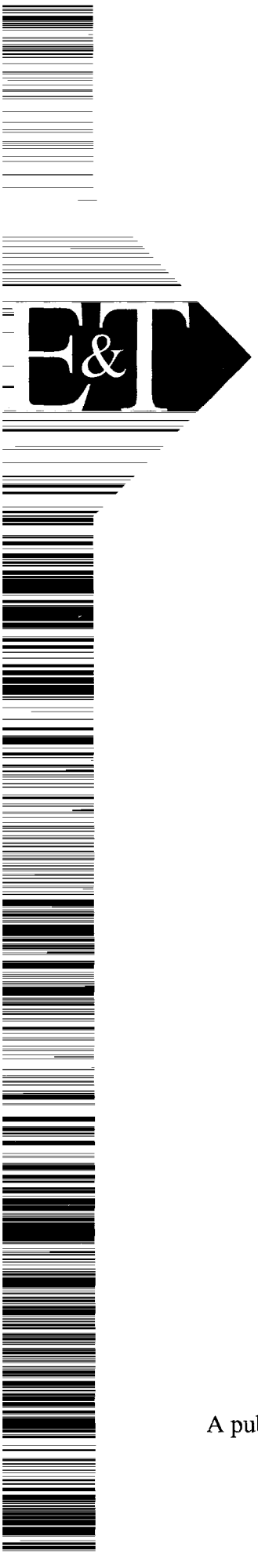

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Interactive Radio Instruction: Twenty-Three Years of Improving Educational Quality

by
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Learners retain approximately 10% of what they read, 26% of what they hear, 50% of what they see and hear, but 90% of what they say and do (Silcox, 1993). It is no wonder, then, that interactive radio instruction (IRI), a methodology developed to turn a typically one way technology into a tool for active learning inside and outside of the classroom, continues after twenty-three years to be an attractive educational strategy in developing countries. The original model for teaching mathematics through IRI, created in Nicaragua by a team from Stanford University in the early 1970s, sought to combine the low cost and high reach of the radio medium and an clear understanding of how people learn. Since that time, eighteen countries around the world have developed IRI programs for a variety of subject matter, audiences and learning environments, many of which have been sustained for up to ten years and counting. The methodology has been expanded and adapted to include different levels of math, science, health, English, Spanish, Portuguese, environmental education, early childhood development, and adult basic education for learners of all ages. In each case, the series has been designed by local specialists specifically to capture the interest of the learner, and to meet learning objectives in that country. Twenty-three years later, the interest in IRI does not seem to be waning. *(see Appendix 1 for a list of IRI projects and their current status)*

Why this Technical Note?

Its purpose is to provide an overview of IRI and elaborate some of the commonalties and research findings in an effort to explore what makes IRI and radio a useful technology that still addresses many educational concerns in developing countries today.

For countries plagued with high hopes but small educational budgets, difficulties in training teachers, providing educational materials, maintaining quality and increasing access to meet the educational needs of a broad populace of learners, chosen strategies and technologies selected must be proven to be effective, reliable, and meet country needs. This note will show that IRI can meet these criteria.

What makes IRI different from other distant learning methods?

IRI is the use of interactive lessons in which an audio component delivered by an 'audio teacher' through a radio or audio cassette, and classroom activities carried out by the learners are carefully integrated. Within this structure, the 'audio teacher' carries the main weight of the teaching, and directs learner activities (exercises, answers to questions, songs, and practical tasks) which take place during carefully timed pauses in the audio script, utilizing the classroom teacher as a facilitator. IRI is distinct from most other forms of distance education because its primary goal has been the improvement of educational quality. Unlike many distant learning efforts that are primarily designed to address issues of access, IRI began as a tool to use in the classroom to counteract low levels of teacher training, poor achievement among learners, and limited resources. While IRI has demonstrated that it can be used to expand access and increase equity in both formal and nonformal educational settings, it retains an emphasis on quality improvement through a development strategy and methodology that requires active learning, attention to pedagogy, and formative evaluation to be included in the design.

The IRI methodology is also different in that it requires learners to react to questions and exercises through verbal response to radio characters, group work and physical and intellectual activities *while the program is on the air.* For both the teacher and student, the lesson becomes an immediate hands-on and experiential guide. Short pauses are provided throughout the lessons after questions and during exercises to ensure that students have the time to adequately think and respond. Interaction is also encouraged within the learning environment among the teacher and learners as they work together to conduct short experiments, do activities, and solve problems using local resources, imaginative situations and stories.

The pedagogy of IRI is more deliberate than active learning alone. IRI series guide participants in the learning process through a progression of activities related to measurable learning objectives. Educational content is organized and distributed across lessons so that learning is built upon previous knowledge and new learners more easily construct an understanding of the subject being taught. Activities and problems are first modeled by radio characters so that the teacher and learners have an idea of the process they are undertaking and the skills and support that may be required. All of these elements are knit together through storylines, music, characterization, and other attributes available through the audio medium.

IRI programs are tailored specifically to the audience and the situation where they will be used. One of the most important aspects of the design, therefore, is the reliance on audience research, participation, and field level formative evaluation to ensure that

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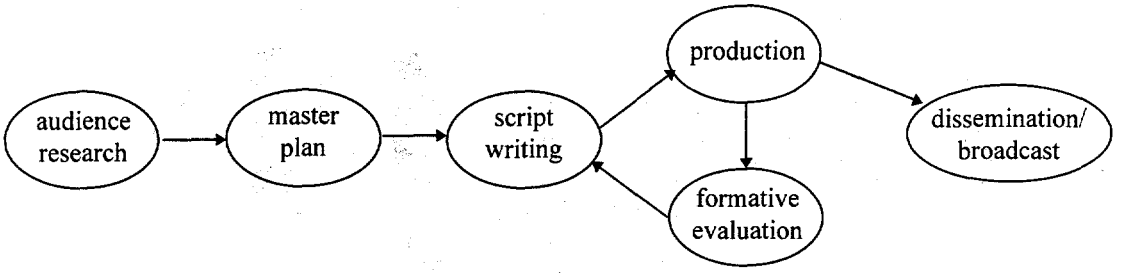
Figure 1. **The development of IRI programs**



lessons are engaging, relevant and that learners can achieve the educational objectives. In the preparation of an IRI series, the format, activities, and pauses in a program change with each cycle of feedback and observation.

What is known about effectiveness?

The attraction of the IRI approach can be at least partially attributed to the insights from well evaluated projects that have repeatedly demonstrated learning gains for students using IRI programs as compared to students in control groups. (see Figure 1). While these data are impressive at face value, they are more impressive when effect sizes are analyzed (taken as the effectiveness quotient in cost-effectiveness studies).

In most cases, students show progressively greater increases in achievement over time. In South Africa, for example, students who received less than 33 'English in Action' lessons improved by 6.7%, students who received between 34 and 66 lessons improved by 13%, and students who received more than 66 programs improved by 24% (Leigh, 1995). Similar results were found in Bolivia. In 1991 evaluators found that the average score of second graders using 'Radio Math' jumped from 47% to more than 66%. (The mean score of the control group was 35%). Of these, the experimental students who had already completed one year of the radio lessons did much better (51.9% correct) and those students who completed two years of radio programs scored even higher (61.6%) (Tilson, et al, 1991).

What about hard-to-reach or out-of-school populations?

The above quoted results have been found in IRI programs for a variety of subjects and learning environments, leading evaluators to assume that it is the basic tenets of active learning and the IRI methodology that make the difference. IRI seems also to ameliorate other obstacles to education and substantial learning gains have been demonstrated in IRI projects that were used in nonformal settings or were used in unusual ways to overcome a particular educational barrier, such as poorly trained teachers, a lack of schools, or incompatible school scheduling. In the Dominican Republic, for example, an IRI project called RADECO was created for children who had no schools and has now been broadcasting for twelve years. In early evaluations, it was discovered that children who had just five hours of integrated instruction a week using IRI and thirty minutes of follow-up activities were compared to students who were in a regular formal schools for more than twice the amount of time. Studies showed that first graders using the RADECO programs responded correctly 51% of the time on post tests, versus 24% of the time for the control group. Second graders using IRI gave 10% more correct answers. Overall, even though these students had enormous obstacles, students who used IRI for an hour a day had comparable results in reading, writing and language for both grades, when compared to the control group. They also performed significantly better in math (reported in Goldstein and de De Jesus, 1995). Based on the early successes of the RADECO project, IRI programs are currently being developed in other countries where different types of obstacles are in place, such as the failing schools of Haiti, nonformal early childhood development centers in Bolivia and Nepal, and adult learning centers in Honduras.

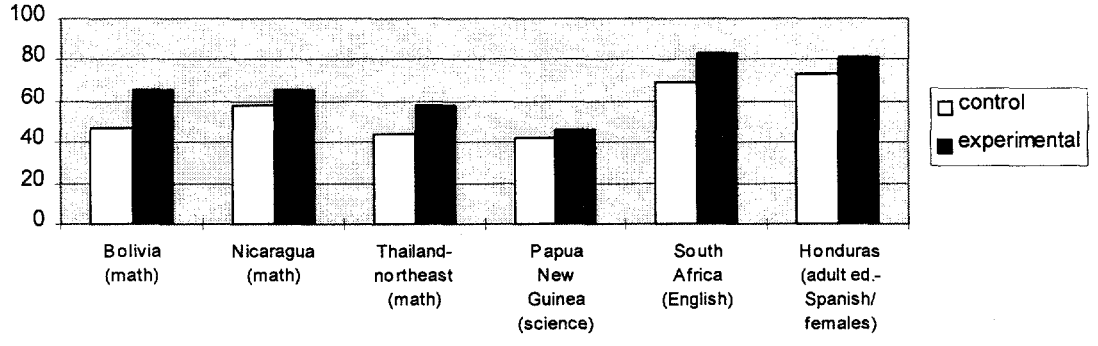
Can IRI help close equity gaps?

Urban/Rural equity gaps: evaluations of IRI programs indicate that they can make a substantial impact on educational equity. In Figure 2, evaluations conducted in Bolivia, Thailand, and South Africa show rural students with much higher total gains than their urban counterparts, who have greater access to materials and better trained teachers. This distribution of evaluation results follows a pattern that has been demonstrated in other countries and indicates that the IRI programs are not only increasing quality, as reflected in gains in achievement, but are also making an impact upon urban/rural equity gaps.

Gender gaps: in a recent retrospective analysis which looked at the potential of IRI to help close gender equity gaps, a similar trend was discovered (Hartenberger and Bosch, 1996). While girls were achieving about the same as boys in the post tests, because their baseline scores were lower, the total achievement for girls in the experimental groups were greater. This finding was demonstrated in science in upper primary school in Papua New Guinea, English in lower primary in South Africa and adult basic education in Honduras, suggesting that the age of the learner and the subject taught were not controlling variables.

Another study of learning gains conducted in Honduras shows that the combination of IRI and other interventions may have synergistic effects. The study found that when IRI programs are introduced with new textbooks, the impact upon learning gains almost

***Figure 2.* Comparisons of Mean Post-test Scores**



effect size:	*.94*	*.58*	*.24*	*.36*	*.72*	*.54*

sources: Tilson, Jamison, Fryer, Edgerton, Godoy-Kain, Imhoof, Christensen and Roy (1991); Leigh, 1995; Corrales, 1995. Raw data are attached in appendix.

doubles the impact of just providing textbooks (with an effect size of .61). The indications are that a well constructed multichannel approach, where different educational strategies are deliberately aligned so that traditional and nontraditional approaches reinforce each other, may have the greatest impact upon learning (Godoy-Kain, 1990).

What is known about the economics of IRI projects?

Alongside the data on learning gains is a growing body of literature analyzing the economics of IRI. A brief description of how IRI projects are generally designed and implemented will help to understand the implications of these studies. IRI projects are front-loaded, that is, they have higher initial fixed costs associated with creating management and training systems and producing audio and print programs, when compared to conventional systems, but far lower recurrent costs associated with permanent staff, dissemination, training and maintenance. While IRI projects have capacity-building components, they are also product-oriented and are evaluated continuously during the early design and production stages to ensure that the products are relevant and effective (figure 1). Because most of the radio programs have gone through this extensive formative evaluation and have built-in strategies of training, active learning and quality control, high level use can be maintained relatively easily over time and the dilution of quality associated with some other strategies, such as pyramid training schemes, can be avoided. Teacher training and other recurrent costs stay relatively consistent over time after the development stage and only vary depending on how much training is integrated into the program, subject being taught, and the special circumstances of the country. Other recurrent costs include airtime, distribution of simple supplementary print materials such as one page worksheets inserted into local newspapers or distributed at the beginning of the year, batteries and radios, and the maintenance of a management system or unit focused on IRI.

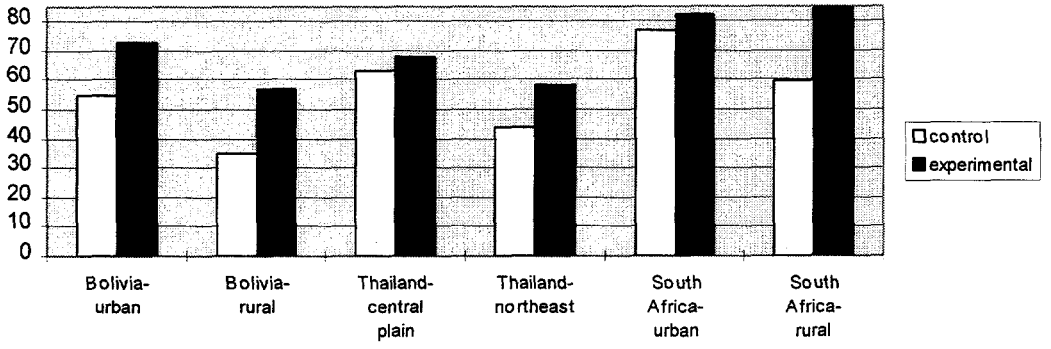
IRI is also different from many other educational strategies because of the wide reach of the radio broadcasts. *As a result, increasing the number of learners increases the cost very little.* In contrast, most other interventions with high variable costs will require a proportional number of new school facilities, textbooks or teachers as additional learners are added. In an IRI project, these extra factors do not dramatically influence the cost of the program and because the primary product, radio programs, are broadcast, the cost per learner decreases proportionally with an increase in users.

Governments using IRI projects have experimented with various cost sharing and income generation schemes to pay for recurrent costs. These strategies have been specific to the special circumstances in each country, but three interesting examples are: (i) Lesotho where a tax pays for a portion of the costs; (ii) Honduras, which is currently experimenting with private-public-NGO strategies of cost-sharing on the municipal level; and (iii) the Bolivia early childhood development series which is experimenting with decentralized methods of sustaining IRI programs through local municipalities. It is also important to note that most IRI projects are at least partially sustained through partnerships between ministries of education and ministries of communication and broadcasting.

What does cost data show?

Most cost analyses of IRI programs project decreasing student costs over time using the underlying principle that the cost of development will be offset as more and more learners use the programs (Jamison, 1990; Tilson, Jamison, Fryer, Godoy-Kain and Imhoof, 1991; and Cobbes, 1995). In a study of Honduras math programs conducted in 1990, for example, it was discovered that the annual cost per student of using IRI mathematics was US$2.94 in the first year when development costs were included (based on 200,000 students and including a discount rate of 7.5%), but the incremental cost to continue the program fell to US$1.01 per student per year thereafter, a cost that would be distributed across learners and Government and reduced dramatically if airtime, the high-

***Figure 3.* Urban/Rural Differentials**



sources: Tilson, Jamison, Fryer, Edgerton, Godoy-Kain, Imhoof, Christensen and Roy (1991); OLSET, 1995. Raw data in appendix.

est cost item, were provided or if the number of learners were increased.

A similar study of Bolivia Math in 1991 found that the cost per student would be US$1.51 in the first year including program development costs and a projected reach of 200,000 students, or US$1.04 if the number of students increased to 600,000. The incremental cost of sustaining the programs for 200,000 students per year, however, was only US$0.81 per student after the development stage (Jamison, 1990, Tilson, 1991). When compared to the traditional math classes, the cost-effectiveness ratio of IRI programs would be 64% higher, assuming 200,000 students per year were reached (Jamison, 1990).

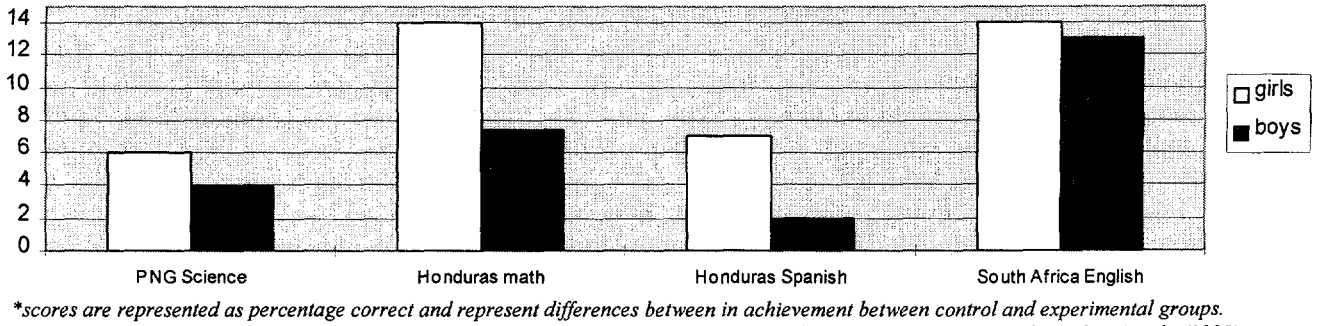
Early criticisms of this analysis suggested that the projected number of learners was too high and that Bolivia would not be able to provide and sustain the use of IRI programs for very long. In 1996, after nine years of broadcasting, over a million learners had used the Bolivia Math and Health programs as part of the Ministry's national curricula, a long term total that even ambitious project evaluators did not anticipate. Records show that 184,490 students and teachers officially used the math programs in 1996, and that if the shadow audience were included,(the incidental listeners or formal or nonformal learners who discovered the series over the airwaves and used it on their own), total learner figures would be even higher. As the cost of airtime had also been distributed among a variety of radio stations around the country, it is likely that the overall cost per student in 1996 was even lower than previously projected.

A study was conducted in Lesotho in 1991 to attempt to understand how the same type of program would compare in a country with completely different circumstances. Using the same methodology, an annual per student cost of US$0.94 was derived, of which only US$0.24 would be covered by the Government. While the per student cost is much lower than Bolivia's, the cost actually constitutes a greater percentage of Lesotho's total education budget than in Bolivia, and therefore indicates a significant education policy decision. Compared to other options, the IRI programs in Lesotho are considered to be cost-effective, and are still being used today.

Is IRI cost-effective when compared to other interventions?

A number of cost-effectiveness studies have also found IRI to be a highly competitive educational strategy when compared to other interventions. As early as 1988, Lockheed and Hanushek published a study that compared cost-effectiveness data on three IRI projects, two textbook projects, and four teacher training projects. Cost-effectiveness was measured as a ratio of incremental

***Figure 4.* Total Achievement in Mean Post-tests by Gender**



**scores are represented as percentage correct and represent differences between in achievement between control and experimental groups.*
sources: Hartenberger and Bosch (1996); Tilson, Jamison, Fryer, Godoy-Kain and Imhoof (1991); Project LearnTech, (1994); Leigh, (1995).

effectiveness (units of effect size) to incremental cost (dollars per student per year) and referred to as the *efficiency ratio*. The study shows that providing textbooks results in an attractive efficiency ratio of about .2 effect units per one dollar per year (with the exception of one case in the Philippines where the gain was 1.5 per dollar). All other interventions were considered less cost-effective than textbooks, with the exception of IRI, which proved to be more cost-effective with efficiency ratios in the .3 to 1.3 range.

Finally, in recent cost analyses conducted in South Africa, evidence suggests that IRI is still proving to be cheaper and more effective than alternative programs. The 1995 study shows that when the cost of South Africa's English in Action is compared with other English language programs, the cost per student of English in Action ranged from one third to one half of that for the other options (Cobbes, 1995). Like other projects, South Africa's English in Action is now broadcast country-wide, indicating that the recurrent costs associated with sustaining the programs are considered justifiable.

How has IRI evolved since the early days?

There are certain trends worth noting in the evolution of IRI since the 1970s. For example, the original concept of making programs "teacher-proof" has been largely discarded. Instead, most newer programs serve as a guide or tool for the teacher, and in some cases, are used for teacher training. The early childhood development series used in Bolivia, Nepal and South Africa, for example, has learning objectives for two audiences, the young learners *and* their teachers and caregivers. This arrangement has been particularly important when the radio characters point out elements of early childhood development as the teachers and caregivers interact with the young children during the IRI program. It has made it possible to use the series as both a nonformal radio program for children, and a hands-on training tool for caregivers and kindergarten teachers. The same strategy has recently been adopted for English programs in the Dominican Republic and Costa Rica so that teacher training is an intrinsic part of the total system.

Characteristics of IRI

Early Prototypes	Current Trends
• regular pauses for learner interaction with radio	• regular pauses for learner interaction with radio
• directed to one audience: the student	• requires interaction amongst learners and teachers/facilitators to facilitate an active learning environment; often directed to two audiences
• distributed learning throughout series	• distributed learning throughout series
• use of known local resources, such as rocks and sticks	• use of known local resources, such as rocks and sticks
• use of characters and imagination to aid in learning	• increased use of characters who act as role models, gender, dramas and imaginary settings
• broadcast over radio	• broadcast over radio, used on cassette, or both
• "teacher proof"	• teacher training deliberately incorporated
• used repetition, reinforcement, and problem solving	• incorporates more constructivist approaches
• incorporates pedagogical principles of how teaching/ learning is constructed	• incorporates pedagogical principles in how teaching/ learning is constructed
• targeted to math and language in school	• used for a variety of subjects and learning environments
• always uses supplementary worksheets for students and guides for teachers	• sometimes uses supplementary materials, depending on ability to disseminate cheaply

Strategies have also been devised to make IRI more entertaining and culturally appropriate for a variety of subject areas. For example, a soap opera/novella style was adopted for the fifth grade environmental education programs in Costa Rica. As a result, story and drama have become popular ways to demonstrate interactions between teachers and learners or to initiate more constructivist styles of learning in various segments of other IRI programs.

More attention is also given to making the programs engaging, relevant and appropriate for both boys and girls. A recent review of research data and script analysis of four IRI programs showed that while girls were making great strides in achievement, the programs did not take full advantage of the potential to present positive role models and interactions between female and male characters. A script analysis process was subsequently created for IRI scriptwriters in order to help IRI programs do better (Hartenberger and Bosch, 1996).

Finally, the design of IRI has evolved in response to educational research and ideological changes in learning theory. For example, South Africa took a particular interest in developing constructivist programs and attempted to make English and math more open to individual discovery and analysis. Even countries with a long history in IRI, such as Bolivia, have shown increasing interest in updating their methods so that their programs are compatible with current interpretations of learning.

What conclusions can be drawn?

IRI applications differ in the degree of activity required of the learners, the subject matter, the age and background of the learn-

ers, the learning environment, and background of the teacher or facilitator. *One might even say that the differences are greater than the similarities.* But despite these differences, and the adjustments that IRI has undergone over time to become more culturally intriguing or educationally up-to-date, *studies consistently demonstrate high learning gains, decreased equity gaps*, and *cost-effectiveness across projects*. The basic structure and methodology of IRI has worked well enough that it is still used in projects around the world twenty-three years after the initial venture.

It is difficult to pin the successes of the IRI methodology on any one characteristic. More likely, a combination of the key factors converges to provide the needed conditions for active and supported learning. The consistency of these factors provides a methodology that seems to be able to fill a needed gap and provide an impartial educational catalyst for teachers and learners across traditional boundaries, such as gender, distance, and access to the highest quality schools.

Where next?

Given this potential, the challenge of the second 'technical note' in this series will be to look into the 'nuts and bolts' of known IRI projects' design and implementation, to determine how differences and similarities have contributed to sustainability: why some countries have overcome obstacles and maintained their programs for up to ten years, while others have not. With this information, educational planners will be adequately briefed to make decisions on the appropriateness of IRI as an educational strategy in their country, and to proceed to the design of projects that will continue to demonstrate IRI's potential for achieving educational effectiveness in the face of limited material and human resources.

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Appendix I

Country/ Start Year	Subject	Status of IRI program today
Nicaragua (1974-)	math, grds 1-3	The first pilot project demonstrated high learning gains and cost-effectiveness, but was abandoned due to the revolution. In the first year, math scores on a standardized test increased from 39% to 65% after a year's broadcasting. Four hundred and sixty-five radio lessons were produced.
Kenya (1980-)	English	The original English as a second language showed learning gains, but was not institutionalized for political reasons. In the first year, language arts students scored 18% higher on a standardized test than those in conventional classes
Thailand (1980-)	math, grds 1-2	Thai Radio mathematics was the first adaptation of the original Nicaragua math series and was used to provide better opportunities to rural students. The series is still broadcast in some areas and is being used on cassette in hilltribe cluster schools in the northeast. Supervisors carry cassettes from school to school on their motorbikes.
Dom. Rep. (1981-)	integrated programming	The RADECO programs were developed to reach children in areas where their were no schools. Four levels of primary education were developed through a combination of radio lessons and supplementary print materials and evaluations showed that students almost as well or better than children in full-day conventional schools. Ten years after its inception, the Government still broadcasts the series. Subjects included math, science. social, sciences, Spanish. A first and second grade math series is also broadcast in formal schools.
Papua New Guinea (1986-)	science, grds 4-6	The Radio Science programs were the first to be created for upper primary and to use an inquiry approach. Because of its higher demands on teachers, it requires a more intense teacher training component. It has been broadcast for ten years and under new privatization struggles, the National Dept. of Education and National Broadcasting Commission are negotiating how to continue to pay for airtime.
Honduras (1987-)	math, grds 1-3	A new series of math programs called *La Familia de los Números* was produced to make the original math model more relevant. The series was based on mental math and enhanced the teacher's role. A total of 465 lessons were produced. While it was not successfully institutionalized, the IRI methodology was changed to meet newer needs in adult education.
Bolivia (1987-)	math, grds 1-5	The Bolivia math programs were a more in depth adaptation of the Nicaraguan series. The first three years were adapted and two subsequent years were created. IRI Math has been broadcast for 10 years and has been a part of the national curriculum. In 1997, the Government is looking for ways to make IRI programming consistent with Educational Reform.
Lesotho (1987-)	English, grds 1-3	English programs are still used nationally. The Ministry of Education has levied a tax to pay for the guidebook which accompanies the IRI programs, and the programs are therefore able to be broadcast in every age appropriate classroom.

Appendix I (cont.)

Country/ Start Year	Subject	Status of IRI program today
Costa Rica, Guatemala, El Salvador, Dom. Rep. (1988-1992)	math, grds. 1-3	Adaptations of the Honduras math were made for neighboring countries. Institutionalization differed per country. The Costa Rica programs are on longer used. The El Salvador the series *El Maravilloso Mundo de los Números* is used nationally as part of the basic education curriculum and additional basic education components are being added.
Costa Rica (1991-)	environ. ed. Grd 4-5	Two pilot series were developed which used adventure stories and a drama format o engage children in environmental activities. The pilot was not institutionalized, but the new style of IRI continues to be replicated in other areas.
Bolivia (1992-)	health, grds. 3-4	Radio Health adapted the IRI methodology to teach health in school through child-to-child strategies. IRI Health has been broadcast nationally for 4 years.
Honduras (1992-)	adult basic education	Three levels of adult basic education have been produced and three additional levels are being created and broadcast through an innovative decentralized strategy at the municipal level. The use of IRI is heavy in the beginning levels and then tapers off in the advanced levels.
South Africa (1992-)	ESL, grds 1-2	Two levels of English in Action have been created in South Africa and a third is being developed. The original English model was recast to serve as a teacher training instrument, and to be more open in its approach. The programs are broadcast nationally.
Indonesia (1992-)	teacher training	A unit was developed within the Government and programs continue to be developed and broadcast.
Portuguese speaking African countries (1992-)	math, grds. 3-4, Portuguese	Originally developed in Cape Verde for eventual use in Angola, Cape Verde, Mozambique, and Sao Tome e Principe, IRI math is now fully financed by the Dutch government through an agreement with UNESCO. One hundred and sixty-three grade three math programs have been produced. Grade four math and Portuguese language programs are planned.
Bolivia (1994-)	early childhood develop.	A new model of IRI was developed to teach ECD practices to adult caregivers and to engage children in developmentally appropriate activities and play. IRI for ECD is both broadcast and used on cassette in three languages and uses a decentralized implementation approach that has been adapted for the Reform. Programs continue to be developed.
Bangladesh (1995-)	English	The Bangladesh Rural Advancement Committee (BRAC) has decided to introduce IRI English in nonformal schools. Ninety lessons have been developed and an adaptation of the Honduras Mental Math programs are being discussed.
Nepal (1996-)	ECD	UNICEF and Radio Nepal are adapting the model created in Bolivia for three regions of Nepal, with increased emphasis on nutrition, health and gender. The pilot is scheduled to go to scale mid-1997.
Pakistan	English	IRI English for grades 3-5 has been adapted for use in the northwest frontier province. The program is expanding from 40,000 students in 800 schools to use in the whole province. Preliminary activities are taking place to expand the program to other provinces.

.ppendix I (cont.)

Country/ Start Year	Subject	Status of IRI program today
Haiti (1996-)	reading, civics, math	Programs are being written and produced in Creole to increase the quality of education in primary school. The project is still in pilot stage.
Ecuador (1996-)	conflict resolution/ critical thinking skills	A pilot program is being developed for ECD, kindergarten and first grade to help adults learn how to facilitate the development of critical thinking skills and conflict resolution in young children. A decentralized approach to development and implementation is being used to be consistent with decentralized education systems.
Dom. Rep./ Costa Rica (1997-)	English	A two country ESL pilot is currently being developed with funds from the World Bank. The series has developed a set of learning objectives for teachers on teacher practice as well as learning objectives for students learning English as a second language.

ppendix II

Raw data from Figures 2-4

Figure 1. Comparisons of Mean Posttest Scores

	Bolivia (math)	Nicaragua (math)	Thailand-northeast (math)	Papua New Guinea (science)	South Africa (English)	Honduras (adult ed.- Spanish/ females)
control	47	58	44	42	70	74
experimental	66	66	58	46	83	81

sources: Tilson, Jamison, Fryer, Edgerton, Godoy-Kain, Imhoof, Christensen and Roy (1991); Leigh, 1995; Corrales, 1995.

Figure 2. Urban/Rural Differentials

	Bolivia-urban	Bolivia-rural	Thailand-central plain	Thailand - northeast	South Africa-urban	South Africa-rural
control	55	35	63	44	76.6	59.4
experimental	73	57	68	58	82	84.3

sources: Tilson, Jamison, Fryer, Edgerton, Godoy-Kain, Imhoof, Christensen and Roy (1991); OLSET, 1995.

Figure 3. Total Achievement by Gender

	PNG Science	Honduras math	Honduras Spanish	South Africa English
girls	6	14	7	14
boys	3.9	7.4	2	13

sources: Hartenberger and Bosch (1996); Tilson, Jamison, Fryer, Godoy-Kain and Imhoof (1991); Project LearnTech, (1994); Leigh, (1995).

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